March 1998
Edition 1.0

FUJITSU

DATA SHEET

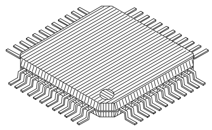
MB3829

System Power Supply IC for Mobile Telephone

DESCRIPTION

This power supply IC incorporates a 4-channel series regulator and a battery backup function. It is a multi-function power supply IC with an output control function and momentary power-loss detection circuit, which are both required for mobile telephones. It also incorporates a speaker amplifier and a buzzer driver. Since it has a built-in power system suitable for mobile telephones, it promises equipment downsizing.

48-PIN PLASTIC LQFP
(FPT-48P-M05)

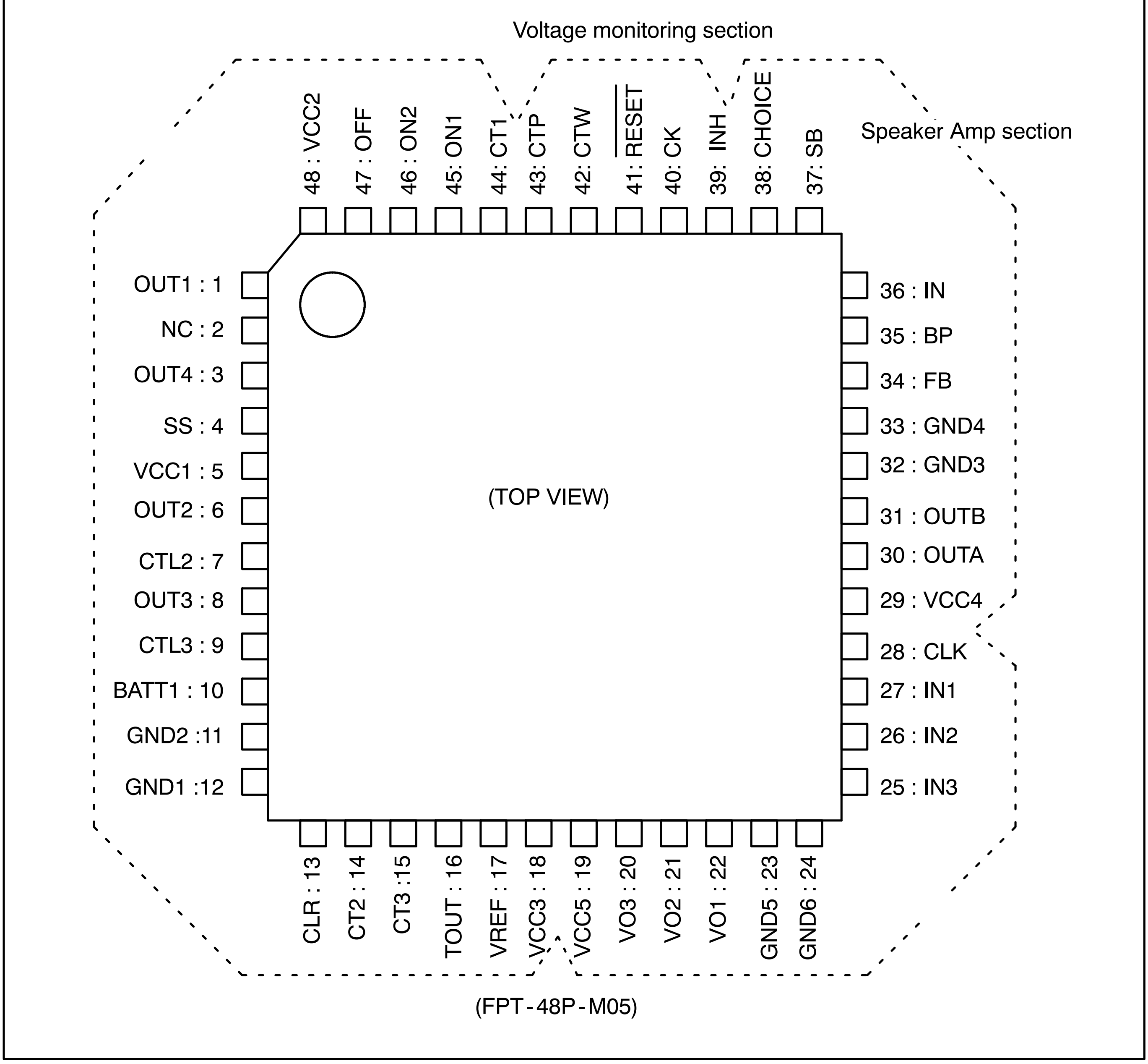


FEATURES

- Power consumption during standby : 0.22 mW (typ.)
- 4-channel low-saturation voltage type series regulator : 6 Ω typ. for channels 1-3; 20 Ω typ. for channel 4
- Battery backup function
- Momentary power-loss and power-restoration functions
- ON/OFF switch circuit with an operating error prevention function
- BTL amplifier for driving the speaker : Output power= 90 mW typ.
- Buzzer driver to permit changing the sound volume : 200 mA max.
- Power supply voltage drops are accurately detected.
- Hysteresis is provided for detection voltage.
- Watchdog timer stop function is provided (inhibit pin).
- Watchdog monitoring time and reset time are set independently.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

PIN ASSIGNMENT



PIN DESCRIPTION

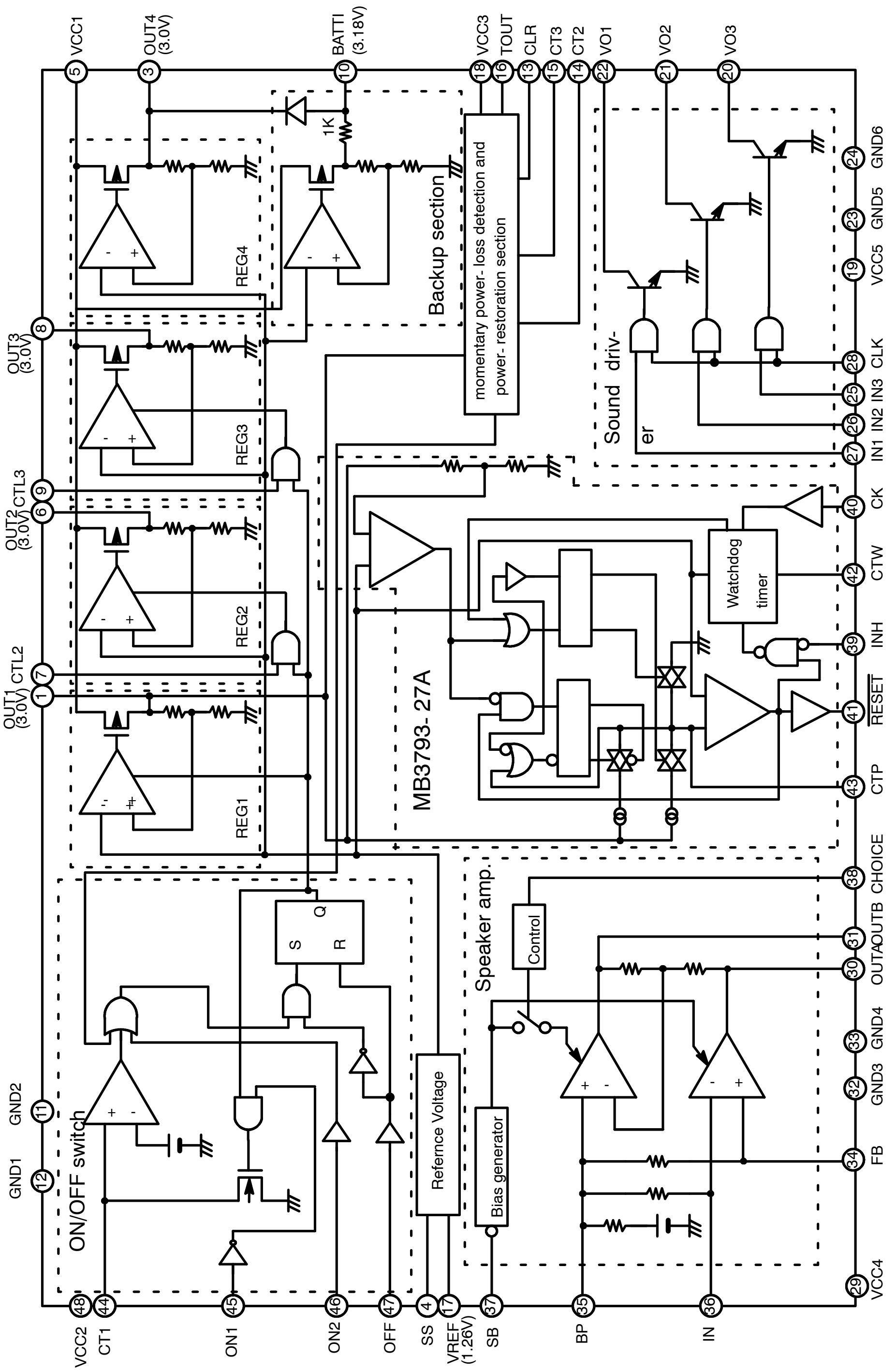
Pin No.		Pin Symbol	I/O	Description
Power supply control section	1	OUT1	O	REG1 output pin (3.0 V)
	2	NC	-	Unconnected pin (open)
	3	OUT4	O	REG4 output pin (3.0 V)
	4	SS	-	VREF slow - start capacitance connection pin
	5	VCC1	-	Power supply pin for power supply control section
	6	OUT2	O	REG2 output pin (3.0 V)
	7	CTL2	I	REG2 control pin In REG1 operating H level: REG2 operation; L level: REG2 OFF
	8	OUT3	O	REG3 output pin (3.0 V)
	9	CTL3	I	REG3 control pin In REG1 operating H level: REG3 operation; L level: REG3 OFF
	10	BATT1	-	Backup battery connection pin
	11	GND2	-	Ground pin
	12	GND1	-	Ground pin
	13	CLR	I	Reset pin for momentary power - loss detection and power - restoration section
	14	CT2	-	Pin for connecting momentary power - loss evaluation time setup capacitor
	15	CT3	-	Pin for connecting momentary power - loss evaluation time setup capacitor and resistor
	16	TOUT	O	Pin for momentary power - loss detection and output (open drain)
	17	VREF	O	Pin for reference voltage output
	18	VCC3	-	Power supply pin for momentary power - loss detection and power - restoration section
Sounder section	19	VCC5	-	Power supply pin for sounder section
	20	VO3	O	Output 3 pin (open collector)
	21	VO2	O	Output 2 pin (open collector)
	22	VO1	O	Output 1 pin (open collector)
	23	GND5	-	Ground pin
	24	GND6	-	Ground pin
	25	IN3	I	Control input 3 pin (H level: VO3 operation)

(Continue)

(Continued)

Pin No.		Pin Symbol	I/O	Description
Sounder section	26	IN2	I	Control input 2 pin (H level: Vo2 operation)
	27	IN1	I	Control input 1 pin (H level: Vo1 operation)
	28	CLK	I	Clock input pin
Speaker amplifier section	29	VCC4	-	Power supply pin for speaker amplifier section
	30	OUTA	O	Output A pin
	31	OUTB	O	Output B pin
	32	GND3	-	Ground pin
	33	GND4	-	Ground pin
	34	FB	I	Inverted input pin
	35	BP	-	Bypass pin
	36	IN	I	Non-inverted input pin
	37	SB	I	Control input pin (H level: speaker amplifier operation)
	38	CHOICE	-	Earphone selection control pin
Voltage monitoring section	39	INH	I	Inhibit pin
	40	CK	I	Clock input pin
	41	$\overline{\text{RESET}}$	O	Reset output pin
	42	CTW	-	Pin for watchdog timer monitoring time setup
	43	CTP	-	Pin for power-on reset hold time setup
Power supply control section	44	CT1	-	Pin for connecting ON time setup capacitor
	45	ON1	I	ON1 pin
	46	ON2	I	ON2 pin
	47	OFF	I	OFF pin
	48	VCC2	-	Power supply pin for ON/OFF switch section

BLOCK DIAGRAM



Function Descriptions

1. Power supply control section

(1) Reference voltage circuit

The reference voltage circuit generates a temperature-compensated, stable voltage ($\approx$ 1.26 V). The generated reference voltage is used as the power supply control section reference voltage or bias.

(2) Series regulator section

A 4-channel series regulator incorporating a low-saturation output transistor is used. All four channels provide an output voltage of 3.0 V. Their characteristics are described below.

REG1 is suitable for a microcontroller power supply because it is connected to a power-on reset circuit. It is controlled by the ON/OFF switch section.

ON/OFF control of REG2 and REG3 is exercised independently by the CTL2 and CTL3 pins while REG1 is ON.

REG4 operates at all times and is therefore suitable for data backup.

REGs 1 through 4 incorporate an overcurrent-protection circuit (REG1 to REG3 $\approx$ -100 mA, REG4 $\approx$ -25 mA).

(3) Battery backup section

When the main battery is installed, the series regulator recharges a button-type lithium secondary battery, which is often used to provide backup for clocks and memory. When the main battery is not installed, the backup battery supplies power to clocks and the battery via a built-in diode. Since the recharging series regulator is set at 3.18 V, this battery backup section is suitable for manganese and lithium batteries.

(4) ON/OFF switch section

When a time-setup capacitance and resistance are connected to the CT1 pin, the ON1 pin makes it possible to set the power supply button activation time. This feature prevents turning ON a mobile telephone accidentally.

The ON2 and OFF pins provide a method of exercising direct ON/OFF control of the regulator.

ON time setting calculation formula: $T_{ON} \approx -C_{T1} \times R_{T1} \times \ln (1 - 1.26V/V_{CC2})$

(5) Momentary power-loss function and power-restoration section

When a time-setup capacitance and resistance are connected to the CT3 pin, a momentary Vcc loss, which may be caused by battery replacement, etc., will be detected so as to deliver output to the TOUT pin. At power restoration, the operating state before the momentary power loss is recovered.

After a momentary power loss, the CLR pin resets the prevailing state so that the momentary power-loss detection circuit retains the latch circuit state.

Momentary power-loss detection time calculation formula: $T_{OFF} \approx -C_{T3} \times R_{T3} \times \ln (1 - (2.3V - 0.27V)/2.3V)$

(6) ON/OFF setup conditions for individual channels

<table>
<tr><th colspan="2">ON/OFF switching section</th><th rowspan="2">CTL2</th><th rowspan="2">CTL3</th><th rowspan="2">REG1</th><th rowspan="2">REG2</th><th rowspan="2">REG3</th><th rowspan="2">REG4</th><th rowspan="2">Battery backup</th></tr>
<tr><th>ON2</th><th>OFF</th></tr>
<tr><td>L</td><td>H</td><td>×</td><td>×</td><td colspan="3">OFF (standby mode)</td><td rowspan="5">ON</td><td rowspan="5">ON</td></tr>
<tr><td rowspan="4">H</td><td rowspan="4">L</td><td>L</td><td>L</td><td rowspan="4">ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>H</td><td>L</td><td>ON</td><td>OFF</td></tr>
<tr><td>L</td><td>H</td><td>OFF</td><td>ON</td></tr>
<tr><td>H</td><td>H</td><td>ON</td><td>ON</td></tr>
</table>

2. Speaker amplifier section

A BTL-output type amplifier is used to drive the speaker directly. The typical output power is as high as 90 mW (at 32 Ω), and the SB pin provides ON/OFF control.

The CHOICE pin controls earphone selection.

3. Sounder section

This section incorporates three low-saturation output transistors for driving the buzzer. IN1, IN2, and IN3 are used to select the output transistor.

4. Voltage monitoring section

This section incorporates the REG1 output voltage detection function and watchdog timer function. It outputs a reset signal to the $\overline{\text{RESET}}$ pin. Further, the detection time varies with the capacitance connected to the CTP and CTW pins.

ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Condition	Value	Unit
Common to all sections	Power-supply voltage	V_{CC}		10	V
	Power dissipation	P_D	$T_A \leq +25°C$	860*	mW
	Storage temperature	Tstg		- 50 to +125	°C
Power supply control section	Output current	I_{O1} to I_{O3}		- 60	mA
		I_{O4}		- 12	mA
Speaker amplifier section	Output current	I_O		150	mA
Sounder section	Output current	I_{O1}	Duty = 50%	240	mA
		I_{O2}	Duty = 50%	120	mA
		I_{O3}	Duty = 50%	60	mA
Voltage monitoring section	Reset output current	I_{OL}, I_{OH}	DC	- 10 to 10	mA

*: Value as mounted on double-sided epoxy board 10 × 10 cm

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS(1)

Parameter		Symbol	Condition	Value			Unit
				Min.	Typ.	Max.	
Common to all sections	Power supply voltage	V_{CC}		3.49		8.0	V
	Power supply voltage buildup time	TV_{CC}		50			μS/V
	Operation temperrature	T_A		- 30	25	85	°C

RECOMMENDED OPERATING CONDITIONS(2)

Parameter			Symbol	Condition	Value Min.	Value Typ.	Value Max.	Unit
Power supply control section	Control input voltage		V_I		0		V_{CC}	V
	Output current		I_{O1} to I_{O3}		-50			mA
			I_{O4}		-10			mA
	Backup current		I_{BATT1}				200	µA
	CLR input pulse width		T_{CLR}		200			ns
	OFF input pulse width		T_{OFF}	CT3 = 2.2 µF, RT3 = 1MΩ	10			ms
	ON2 input pulse width		T_{ON2}		10			µs
	ON setting time setup	Capacitance	C_{T1}			1.5		µF
		Resistance	R_{T1}			1		MΩ
	Momentary power-loss time setup	Capacitance	C_{T3}			2.2		µF
		Resistance	R_{T3}			1		MΩ
Speaker amplifier section	Control input voltage		V_I		0		V_{CC}	V
	Amplifier input voltage		V_{IN}		0.3		V_{CC}-0.8	V
	Load resistance		R_L		8	32	200	Ω
	Gain setting range		AV	When Non-INV input	6	24	36	dB
				When INV input	-26	-20	36	dB
Sounder section	Control input voltage		V_I		0		V_{CC}	V
	Output current		I_{O1}	Duty = 50%			200	mA
			I_{O2}	Duty = 50%			100	mA
			I_{O3}	Duty = 50%			50	mA
Voltage monitoring section	$\overline{\text{RESET}}$ output current		I_{OL}, I_{OH}		-3		3	mA
	Reset/hold time setup capacitance		C_{TP}		0.001		10	µF
	Clock monitoring time setup capacitance		C_{TW}		0.001		1	µF
	Clock monitoring time setting		T_{WD}		0.1		1500	ms

Note: The recommended operating conditions are the recommended values guaranteeing normal LSI operations. The specified values for electrical characteristics are guaranteed when the conditions in the Condition column, as well as the recommended operating conditions, are met.

ELECTRICAL CHARACTERISTICS

1. Power supply control section

($V_{CC1,2,3}$ = +3.6V, T_A = +25°C)

Parameter		Symbol	Condition		Value			Unit
					Min.	Typ.	Max.	
Reference voltage section	Reference voltage	V_{REF}	I_O=0mA		1.23	1.26	1.29	V
Constant Voltage Controller (REG1)	Output voltage	V_O	I_O=0mA		2.90	3.00	3.13	V
		V_O	I_O=-50mA		2.90	3.00	3.13	V
	Output saturation voltage	V_{SAT}	I_O=-22mA, V_{CC}=3V			0.15	0.27	V
	Temperature regulation of output voltage	$\Delta V_O/V_O$	T_A=-30 to +85 °C *			1	2	%
	Input stability	Line	V_{CC}=3.49V to 8V,I_O=-10mA			10	50	mV
	Load stability	Load	I_O=0mA to -50mA			10	50	mV
	Ripple removal ratio	R.R	V_{IN}=0.2Vrms,	f=25Hz *	38	50		dB
			I_O=-10mA	f=1kHz *	23	35		dB
	Rise time	T_R	C=10µF, R=60Ω *			250	410	µs
Constant Voltage Controller (REG2,3)	Output voltage	V_O	I_O=0mA		2.90	3.00	3.13	V
		V_O	I_O=-50mA		2.90	3.00	3.13	V
	Output saturation voltage	V_{SAT}	I_O=-40mA, V_{CC}=3V			0.25	0.45	V
	Temperature regulation of output voltage	$\Delta V_O/V_O$	T_A=-30 to +85 °C *			1	2	%
	Input stability	Line	V_{CC}=3.49V to 8V,I_O=-10mA			10	50	mV
	Load stability	Load	I_O=0mA to -50mA			10	50	mV
	Ripple removal ratio	R.R	V_{IN}=0.2Vrms,	f=25Hz *	38	50		dB
			I_O=-10mA	f=1kHz *	23	35		dB
	Input-on condition	V_{ON}	-		2.0		V_{CC}	V
	Input-off condition	V_{OFF}	-		0		0.8	V
	Input current	I_{IH}	V_I=3.0V			17	30	µA
		I_{IL}	V_I=0.4V		1	2	3	µA
	Rise time	T_R	C=10µF, R=60Ω *			250	410	µs

*: Guaranteed by design

($V_{CC1,2,3}$ = +3.6V, T_A = +25°C)

Parameter		Symbol	Condition		Value Min.	Value Typ.	Value Max.	Unit
Constant Voltage Controller (REG4)	Output voltage	V_O	I_O=0mA		2.90	3.00	3.13	V
		V_O	I_O=-10mA		2.90	3.00	3.13	V
	Output saturation voltage	V_{SAT}	I_O=-2mA, V_{CC}=3V			0.05	0.1	%
	Temperature regulation of output voltage	$\Delta V_O/V_O$	T_A=-30 to +85 °C *			1	2	mV
	Input stability	Line	V_{CC}=3.49V to 8V			10	50	mV
	Load stability	Load	I_O=0mA to -10mA			10	50	dB
	Ripple removal ratio	R.R	V_{IN}=0.2Vrms,	f=25Hz *	38	50		dB
			I_O=-2mA	f=1kHz *	4	16		V
	Output leakage current	I_{LEAK}	V_{CC1}=0 to 2.97V, V_{BATT1}=0V, V_{O4}=3V			1.2	10	µA
	Rise time	T_R	C=10µF, R=300Ω, SS=1nF *			900	1450	µs
Backup Section	Output voltage	V_{BATT1}	I_{BATT1}=0µA		3.10	3.18	3.25	V
	Charging current	I_{BATT1}	V_{BATT1}=2.0V			-1.18	-0.59	mA
	Output saturation voltage	ΔV_O	V_{CC1}=0V, I_{O4}=-20µA		0.52	0.57	0.62	V
	Output leakage current	I_{LEAK}	V_{CC1}=0 to 2.97V, V_{BATT1}=3V, V_{O4}: Short-circuited to V_{BATT1}			2.1	10	µA
ON/OFF switch section	Input-on condition	V_{ON}	-		2.0		V_{CC}	V
	Input-off condition	V_{OFF}	-		0		0.8	V
	Input current	I_{IH}	V_I=3.0V			17	30	µA
		I_{IL}	V_I=0.4V		1	2	3	µA
	Threshold voltage	V_{TH}	CT1 pin *		1.21	1.26	1.31	V
	CT3 output resistance	R_{ON}	OFF=H		0.5	1	1.5	kΩ
	ON setup time	T_{ON}	CT1=1.5µF, RT1=1MΩ		550	650	750	ms

*: Guaranteed by design

($V_{CC1,2,3}$ = +3.6V, T_A = +25°C)

Parameter		Symbol	Condition	Value			Unit
				Min.	Typ.	Max.	
Instantaneous Detection/ Power Restoration Section	Detection voltage	V_{THL}	V_{CC} pin	1.90	2.2	2.5	V
	Instantaneous detection time	T_{OFF}	CT3=2.2μF, RT3=1MΩ	4.0	4.7	5.5	s
	Input-on condition	V_{ON}	CLR pin	2.0		V_{CC}	V
	Input-off condition	V_{OFF}	CLR pin	0		0.8	V
	Input current	I_{IH}	V_I=3.0V		17	30	μA
		I_{IL}	V_I=0.4V	1	2	3	μA
	Output leakage current	I_{LEAK}	$V_{CC1,2,3}$ = V_O=8V			10	μA
	Output saturation voltage	V_{SAT}	I_O=100μA		0.1	0.3	V
Power supply control section	Stand-bycurrent	I_{CC1}	REG1 to REG3 : OFF I_{O4}=-100μA I_{BATT1}=-200μA		60	90	μA
	Power-off current	I_{CC2}	REG2,3 : OFF I_{O1}=-11mA, I_{O4}=-100μA I_{BATT1}=-200μA		160	240	μA
	Power-oncurrent	I_{CC3}	REG3 : OFF I_{O1}=-11mA, I_{O2}=-30μA I_{O4}=-100μA I_{BATT1}=-200μA		190	280	μA
	Power-oncurrent	I_{CC4}	I_{O1}=-11mA, I_{O2}=-40mA I_{O3}=-12mA, I_{O4}=-100μA I_{BATT1}=-200μA		360	530	μA
	Power-oncurrent	I_{CC5}	I_{O1} to I_{O4}, I_{BATT1} : No load		160	240	μA

Note: The Icc1 to Icc5 values for the whole power supply control section represent the sum of Vcc1 to Vcc3 pin current values except the load current.

2. Speaker amplifier section

($V_{CC1,2,3}$ = +3.6V, T_A = +25°C)

Parameter		Symbol	Condition	Value			Unit
				Min.	Typ.	Max.	
Speaker amplifier section	Voltage gain	A_V	Non-INV input	22	24	26	dB
	Release voltage gain	A_{VO}	f ≤ 100 Hz *		80		dB
	Output power	P_D	R_L = 32 Ω, THD = 10 %	60	90		mW
	Output voltage	V_O	No load	3.8	5.5		V
	Offset voltage between output	V_{OO}	-	-50		50	mV
	Distortion rate of all high frequencies	THD	P_O ≥ 25 mW		0.5	1.0	%
	Ripple extraction ratio	PSRR	- *	33	45		dB
	Rise time	T_R	P_O ≥ 25 mW, BP=4.7µF *			0.25	s
Earphone	Voltage gain	A_{VI}	-	16	18	20	dB
	Output voltage	V_{OI}	No load	1.4	2.75		V
	Rise time	T_R	P_O ≥ 6 mW, BP=4.7µF *			0.25	s
Input impedance		R_{IN}	-	20	30	50	kΩ
Input-ON condition		V_{ON}	-	2.0		V_{CC}	V
Input-OFF condition		V_{OFF}	-	0		0.8	V
Input current		I_{IH}	V_{SB}=3.0V		17	30	µA
		I_{IL}	V_{SB}=0.4V		0	1	µA
Power-supply current at standby		I_{CC1}	-		0	10	µA
Power-supply current at no load (Speaker mode)		I_{CC2}	When no signal		3	5	mA
Power-supply current at no load (Earphone mode)		I_{CC3}	When no signal		1.5	2.5	mA
Speaker ON condition		VSON	-	0		0.8	V
Earphone ON condition		VEON	-	2.0		V_{CC}	V

*: Guaranteed by design

3. Sounder

(V_{CC5} = +3.6V, T_A = +25°C)

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Output voltage	V_{O1}	I_{O1} = 200 mA		0.3	0.5	V
	V_{O2}	I_{O2} = 100 mA		0.3	0.5	V
	V_{O3}	I_{O3} = 50 mA		0.3	0.5	V
Output leakage current	I_{LEAK}	$V_{CC1,2,3}$=V_O = 8 V			10	µA
Input - ON condition	V_{ON}	-	2.0		V_{CC}	V
Input - OFF condition	V_{OFF}	-	0		0.8	V
Input current	I_{IH}	V_I = 3.3 V		34	60	µA
	I_{IL}	V_I = 0.4 V	2	4	6	µA
Power - supply current at standby	I_{CC1}	-		2	10	µA
Power - supply current at no load	I_{CC2}	V_{IN1} = 3.0 V, CLK Duty = 50%		3.0	4.5	mA
	I_{CC3}	V_{IN2} = 3.0 V, CLK Duty = 50%		1.5	2.3	mA
	I_{CC4}	V_{IN3} = 3.0 V, CLK Duty = 50%		0.8	1.2	mA

4. Voltage monitoring section

(OUT1 = +3.0V, T_A = +25°C)

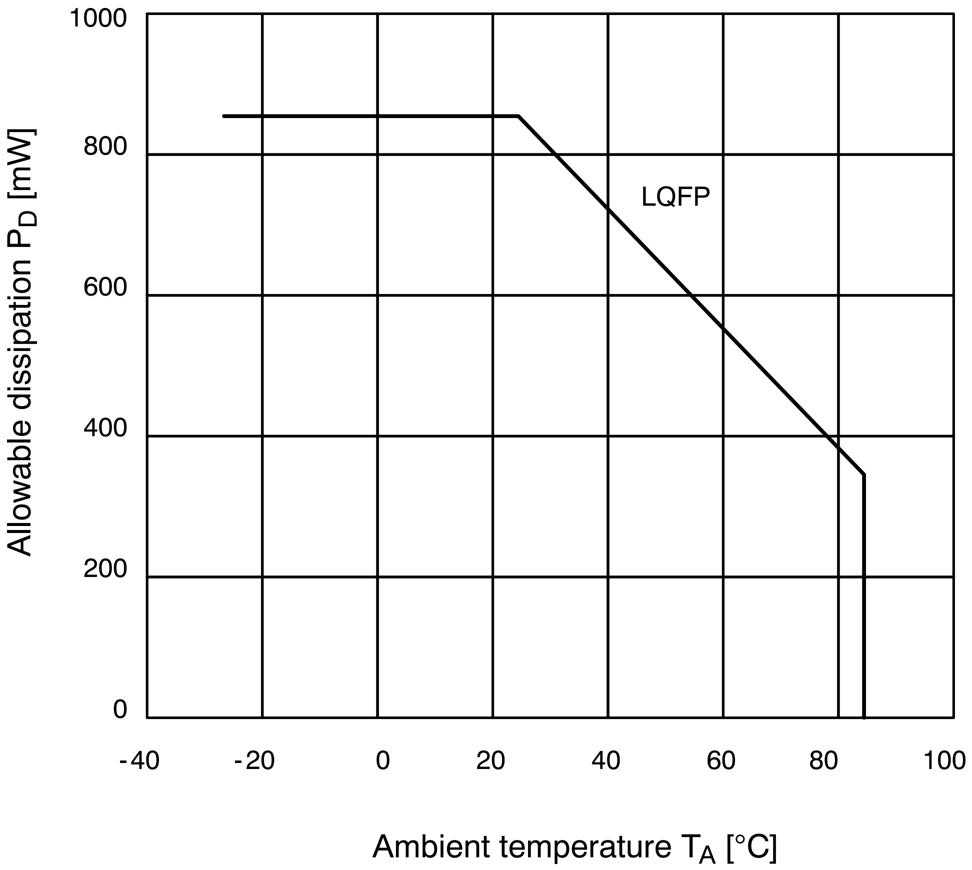
Parameter		Symbol	Condition	Value			Unit
				Min.	Typ.	Max.	
Detection voltage		V_{SL}	OUT1 fall	2.70	2.75	2.81	V
		V_{SH}	OUT1 rise	2.76	2.81	2.87	V
Detection voltage hysteresis width		V_{SHYS}	V_{SH} - V_{SL}	35	65	95	mV
CK input threshold voltage		V_{CIH}	-	0.6	1.2	1.8	V
		V_{CIL}	-	0.4	0.9	1.4	V
CK input hysteresis width		V_{CHYS}	-	0.1	0.3	0.6	V
Inhibit input voltage		V_{IIH}	-	1.8			V
		V_{IIL}	-			0.8	V
Input current	CK IHB	I_{INH}	V_{IN} = OUT1		0	1.0	μA
		I_{INL}	V_{IN} = GND	-1.0	0		μA
Reset output voltage		V_{OH}	$\overline{I_{RESET}}$ = -3mA	2.5	2.8		V
		V_{OL}	$\overline{I_{RESET}}$ = +3mA		0.12	0.4	V
Reset output minimum voltage		V_{CCL}	$\overline{I_{RESET}}$ = +50μA		0.8	1.2	V
Power-on reset hold time		t_{PR}	C_{TP} = 0.1μF	25	70	115	ms
Watchdog timer monitoring time		t_{WD}	C_{TW}=0.01μF, C_{TP}=0.1μF	8	16	24	ms
Watchdog timer reset time		t_{WR}	C_{TP} = 0.1μF	1.5	5	8.5	ms
Clock input pulse width		t_{CKW}	- *	500			ns
Clock input pulse cycle		t_{CKT}	- *	20			μs
$\overline{\text{RESET}}$ rise time		t_r *1	C_L = 50pF *	2.0		500	ns
$\overline{\text{RESET}}$ fall time		t_r *1	C_L = 50pF *			500	ns
Delay time from OUT1		T_{PD}	- *		2	20	μs
OUT1 input pulse width		T_{PI}	1.2V to 2.5V *	16			μs

*1: The voltage range prevailing during $\overline{\text{RESET}}$ output rise/fall time measurement is from 10% to 90%

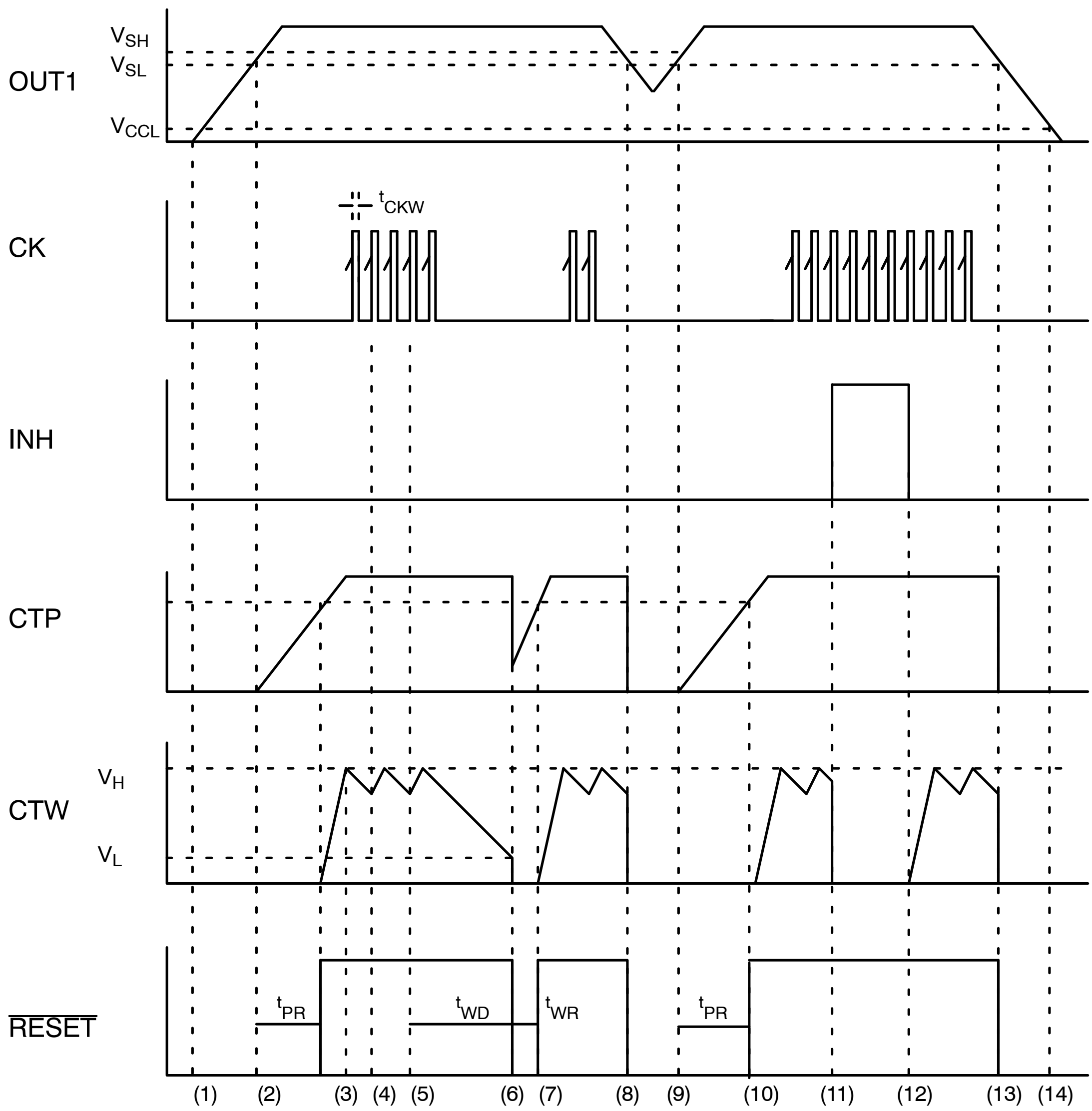
*: Guaranteed by design

TYPICAL CHARACTERISTICS CURVE

Allowable dissipation vs. ambient temperature curve



VOLTAGE MONITORING SECTION TIMING CHART



DESCRIPTION OF OPERATION

(The numbers in the timing diagram correlate to the numbers (1) to (13) below.)

(1) When the REG1 output voltage (OUT1) is about 0.8 V (V_{CCL}), the reset signal is output.

(2) When OUT1 reaches a level higher than the detection voltage (V_{SH}), the power-on reset/hold time setup capacitor (C_{TP}) begins to charge. The V_{SH} value is 2.81 V.

(3) When the power-on reset/hold time setup pin (C_{TP}) voltage rises above the threshold level (Vth), the reset clears (RESET pin voltage changes from L level to H level). The Vth value is about 1.9 V.
The power-on reset/hold time (t_{PR}) is expressed by the following equation.
Also, the watchdog timer monitoring time setup capacitor (C_{TW}) begins to charge.

$$t_{PR}\,[\text{ms}] \approx A \times C_{TP}\,[\mu\text{F}]$$
$$A \approx 700$$

(4) When the watchdog timer monitoring time setup pin (C_{TW}) voltage reaches the Hi level (V_H), the C_{TW} changes from the charged state to the discharged state. The V_H value is about the reference voltage of 1.24 V.

(5) When a clock pulse input is applied to the clock pin (CK) and then the next clock pulse input is applied (positive edge trigger) to the CK pin during a C_{TW} discharge, switching from the discharged state to the charged state occurs.

(6) If a clock pulse input is not delivered to the clock pin (CK) within the watchdog timer monitoring time (tWD), the CTW pin voltage falls below the Lo level (V_L) so the reset signal is output ($\overline{\text{RESET}}$ pin voltage changes from H level to the L level).
The V_L value is about 0.24 V.
The watchdog timer monitoring time (t_{WD}) is expressed by the following equation.

$$t_{WD}\,[\text{ms}] \approx B \times C_{TW}\,[\mu\text{F}]$$
$$B \approx 1600$$

(7) When the C_{TP} is recharged to raise the C_{TP} pin voltage above Vth, the reset clears, allowing the watchdog timer to start running.
The watchdog timer monitoring reset time (t_{WR}) is expressed by the following equation.

$$t_{WR}\,[\text{ms}] \approx D \times C_{TP}\,[\mu\text{F}]$$
$$B \approx 50$$

(8) When the OUT1 drops below the fall period detection voltage (V_{SL}), the C_{TP} pin voltage falls so that the reset signal is output ($\overline{\text{RESET}}$ pin voltage changes from H level to the L level).
The V_{SL} value is about 2.75 V.

(9) When the OUT1 rises above V_{SH}, C_{TP} charging starts.

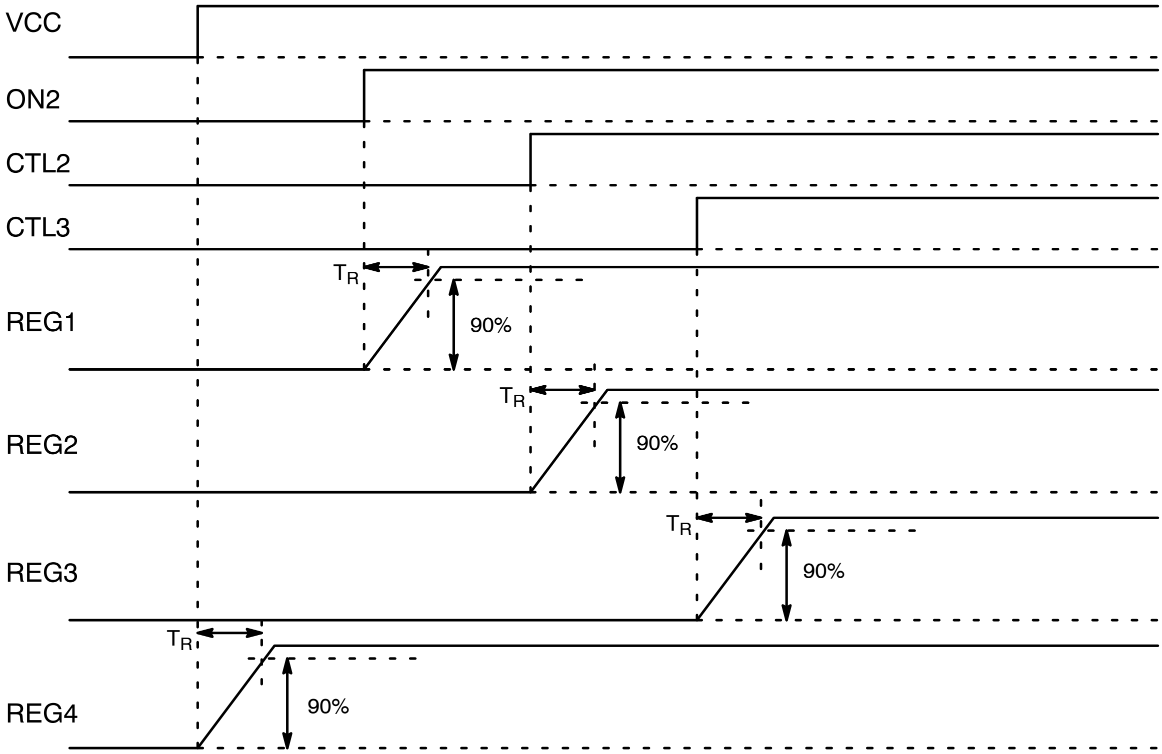
(10) When the C_{TP} pin voltage rises above Vth, the reset clears, causing the watchdog timer to start running.

(11) When the inhibit signal is input (Hi level), the watchdog timer operation is forcibly stopped.
In this case, only the watchdog timer stops and the OUT1 monitoring operations ((8) to (10)) are performed. If the inhibit input does not clear, the watchdog timer does not operate.

(12) When the inhibit input clears (becomes Lo level), the watchdog timer begins to operate.

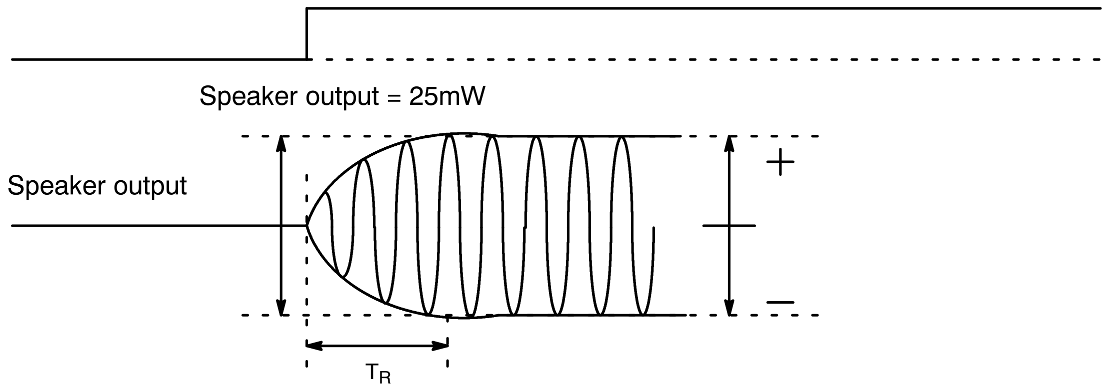
(13) When the REG1 output turns OFF and OUT1 falls below V_{SL}, the reset signal is output.

REG SECTION RISE TIMING REQUIREMENTS

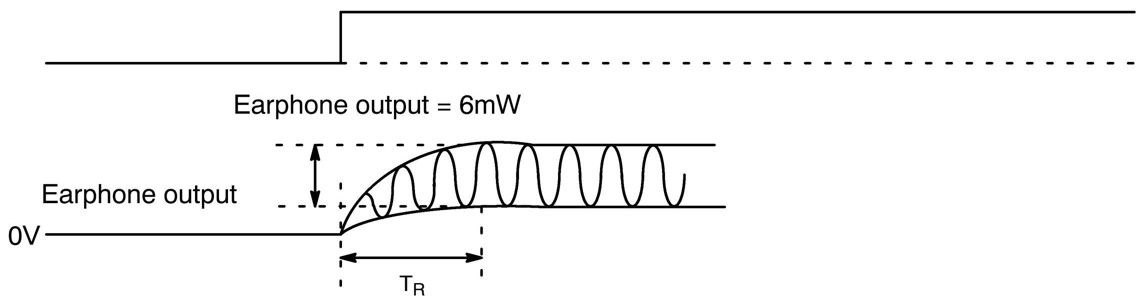


SPEAKER AMPLIFIER SECTION RISE TIMING REQUIREMENTS

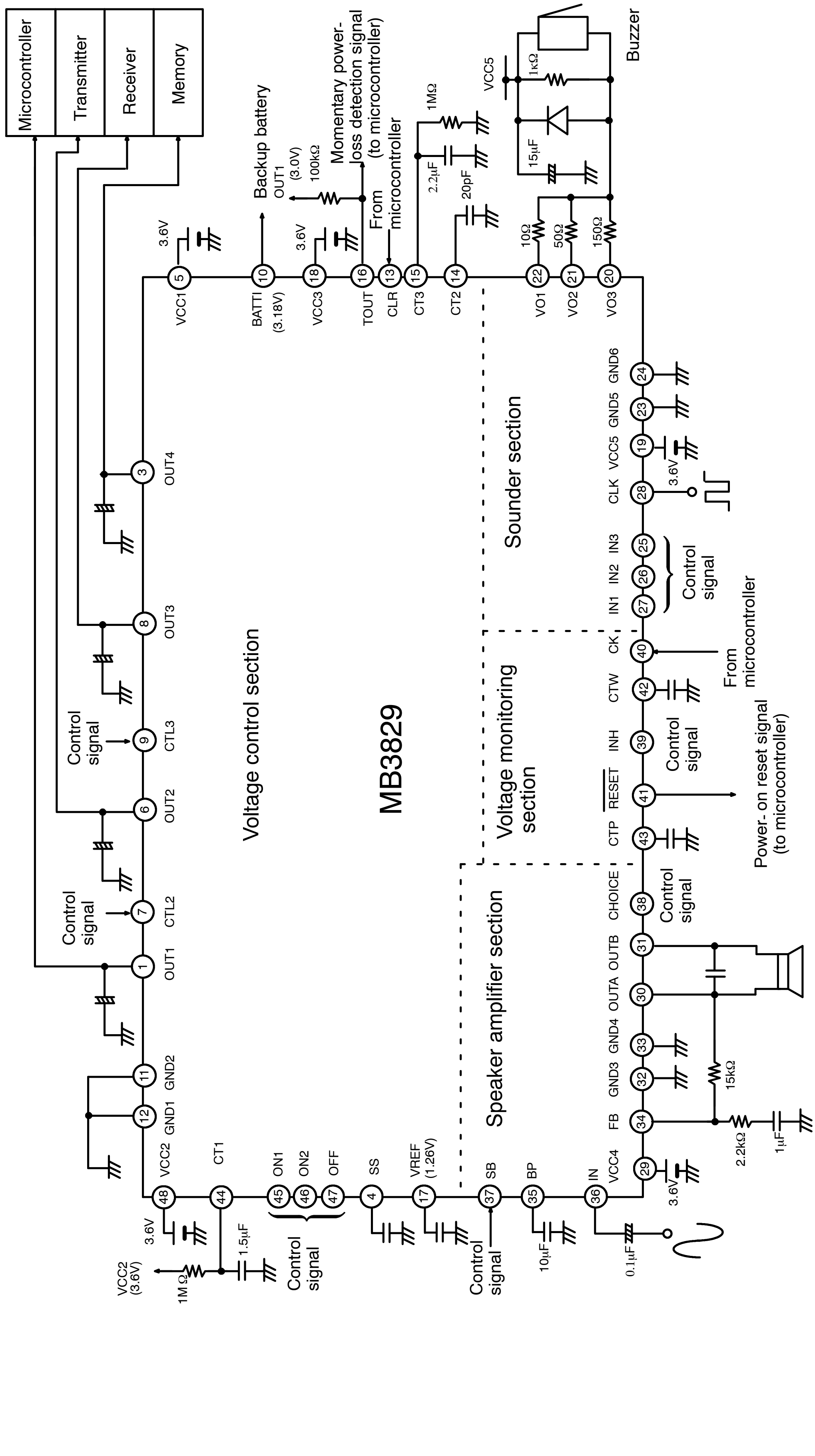
VCC4=VSB CHOICE= L (BP=4.7μF)



VCC4=VSB =CHOICE (BP=4.7μF)



APPLICATION CIRCUIT



USAGE PRECAUTIONS

1. Device settings must not exceed the maximum ratings.

Usage under conditions exceeding absolute maximum ratings may permanently damage LSI devices.

Note also that in normal operation usage within recommended operating conditions is preferred, and that the reliability of LSI devices may be adversely affected when used outside these conditions.

2. Devices should be used within recommended operating conditions.

Recommended operating conditions are recommended values within which the LSI device is warranted to operate normally.

Rated values of electrical characteristics are warranted within the range of recommended operating conditions and within the conditions listed in the condition column for each parameter.

3. The PC board ground line must be designed by taking the common impedance.

4. Guard against static electricity.

The semiconductor containers must be protected against static electricity or made of conductive materials.

When storing or transporting a component-mounted PC board, place it in a conductive bag or container.

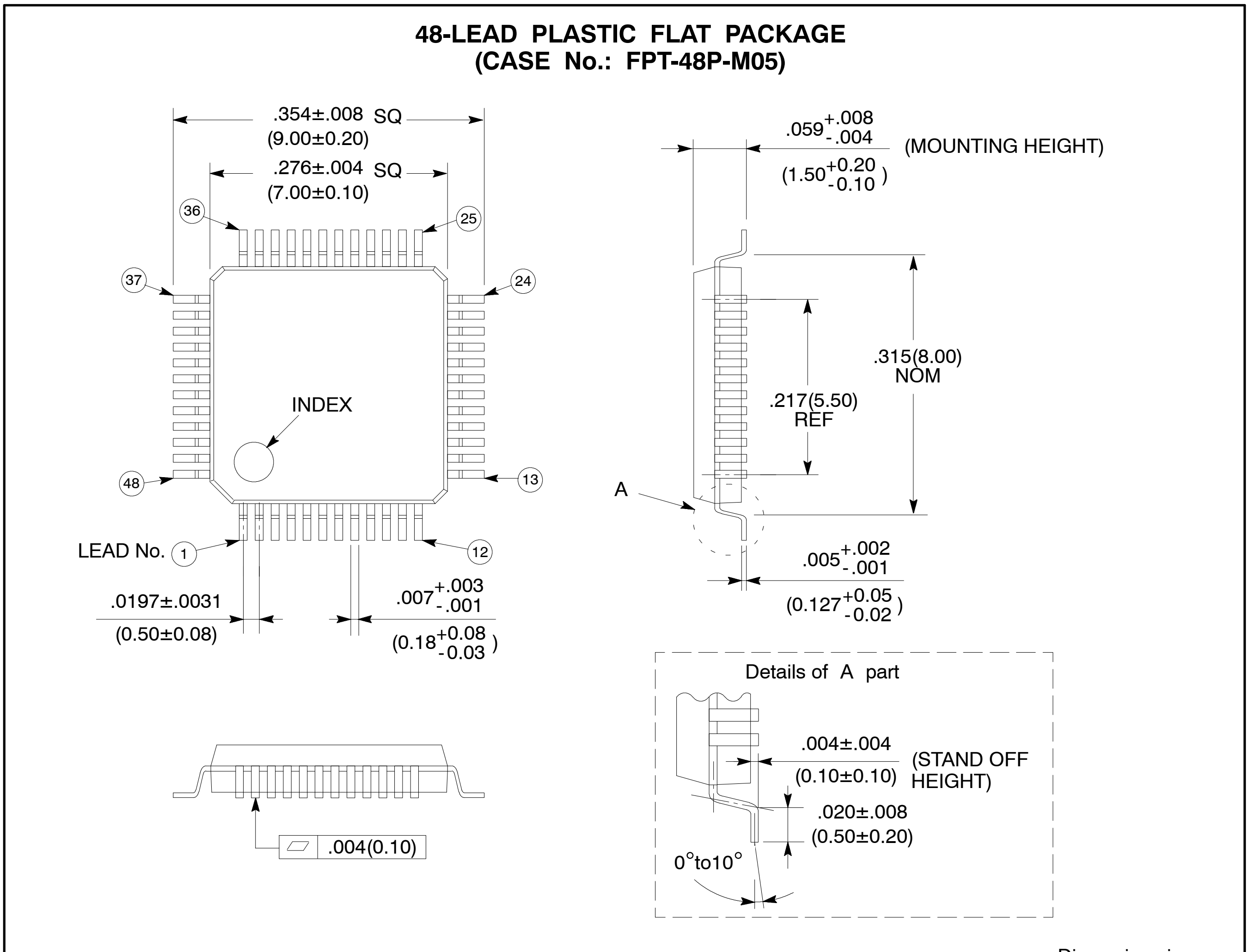
Ensure that the workbenches, tools, and measuring instruments are grounded.

Workers must be grounded via a series resistance of 250 kΩ to 1 MΩ.

ORDERING INFORMATION

Part number	Package	Remarks
MB3829PFV-G-BND	Plastic, LQFP, 48-pin (FPT-48P-M05)	

PACKAGE DIMENSIONS



Dimensions in inches (millimeters)

MEMO

FUJITSU LIMITED

For further information please contact:

Japan

FUJITSU LIMITED
Corparate Grobal Business Support Div.,
Electronic Devices
4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki-shi,
Kanagawa-ken 211-8588, Japan
Tel: (044) 754-3763
FAX: (044) 754-3329

North and South America

FUJITSU MICROELECTRONICS, INC.
Integrated Circuits Division
3545 North First Street
San Jose, CA 95134-1804, USA
Tel: (408) 922-9000
FAX:(408) 922-9179

Europe

FUJITSU MIKROELEKTRONIK GmbH
Am Siebenstein 6-10,
63303 Dreieich-Buchschlag,
Germany
Tel: (06103) 690-0
FAX: (06103) 690-122

Asia

FUJITSU MICROELECTRONICS ASIA PTE LIMITED
#05-08, 151 Lorong Chuan
New Tech Park
Singapore 556741
Tel: (65) 281-0770
FAX: (65) 281-0220